

A SAFETY STUDY OF
THE OPERATIONAL RELATIONSHIP
BETWEEN SHIP MASTERS/
WATCHKEEPING OFFICERS
AND MARINE PILOTS

REPORT NUMBER SM9501

TABLE OF CONTENTS

	PAGE
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Objective	5
1.3 Scope and Methodology	5
2.0 THE MASTER/PILOT RELATIONSHIP	7
2.1 Communication	8
2.1.1 Manoeuvring Characteristics of the Vessel	10
2.1.2 Local Conditions	11
2.1.3 Manoeuvring and Passage Plans	12
2.1.4 Hand-over Briefings	15
2.1.5 Radio Communications	15
2.1.6 Language	16
2.2 Monitoring of the Vessel Movements	17
2.3 Teamwork	19
2.3.1 Factors Affecting Effective Teamwork	20
Personal Attitudes	20
Corporate Perspective	21
Training Requirements	22
Pilots' Liability	23
2.3.2 Foreign Practices	24
3.0 SUMMARY OF FINDINGS	26
4.0 RECOMMENDATIONS	28
4.1 Hand-over Briefings	28
4.2 Language	29
4.3 Monitoring of Vessel Movements	30
4.4 Teamwork	31
5.0 APPENDICES	
APPENDIX A - TABULATION OF MASTER/PILOT EXPERIENCES	33
APPENDIX B - TABULATION OF DEMOGRAPHIC INFORMATION	39

1.0 INTRODUCTION

On 07 June 1992, the Swedish-flag container/roll-on roll-off vessel "CONCERT EXPRESS" was under the conduct of a pilot in Halifax Harbour in dense fog. During a manoeuvre around a vessel at anchor, the "CONCERT EXPRESS" grounded and sustained extensive hull bottom damage. The TSB determined that, among the factors contributing to the grounding, no complete harbour-entry plan had been discussed nor decided upon. In addition, the master did not make a timely contribution to the vessel's safe navigation due to a lack of communication with the pilot whose intentions were not understood by the master until the vessel was approaching a critical position. (M92M4023)¹

1.1 Background

Between February 1981 and May 1992, 273 occurrences involving vessels in Canadian pilotage waters, under the conduct of a pilot, were investigated by the Marine Casualty Branch of the Canadian Coast Guard or, after 1990, by the Transportation Safety Board of Canada ("TSB", "the Board"). Vessels greater than 5,000 gross registered tons were involved in 87% of these 273 occurrences.

The 273 occurrences were made up of five types:

- Collisions 43 collisions with another vessel underway
- Groundings 88 vessels struck shoals, touched bottom or an underwater reef and remained stranded until refloated
- Strikings 95 vessels struck a stationary object, such as a vessel not underway, a quay or other fixed installation
- Contacts 46 light impacts with another vessel, marker, buoy or the bottom
- Sinking 1 vessel became submerged from water intake below the water line and settled to the bottom

¹ Numbers in brackets refer to published TSB occurrence investigation reports.

Table 1 shows the frequency of these occurrences and the types of vessels involved.

Vessel Type	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Total
General Cargo	8	9	9	6	8	7	5	4	5	6	5		72
Bulk Carrier	19	17	12	12	8	9	11	7	9	10	13	3	130
Tanker	8	3	6	2	3	2	4	8	5	6	2		49
Ore/Bulk/Oil		1				1	1						3
Container								1	1			2	4
Ro-Ro				1	2			2					5
Passenger				1					1				2
Tug & Barge	1	1			1								3
Other		1	2	1		1							5
Total	36	32	29	23	22	20	21	22	21	22	20	5	273

Table 1
Annual Occurrences by Vessel Type

The Board, concerned by the frequency and potential consequences of such occurrences, conducted a preliminary examination consisting of a review of these 273 occurrences. For each occurrence, the most significant factor contributing to the occurrence was identified. Figure 1 shows the distribution of these contributing factors.

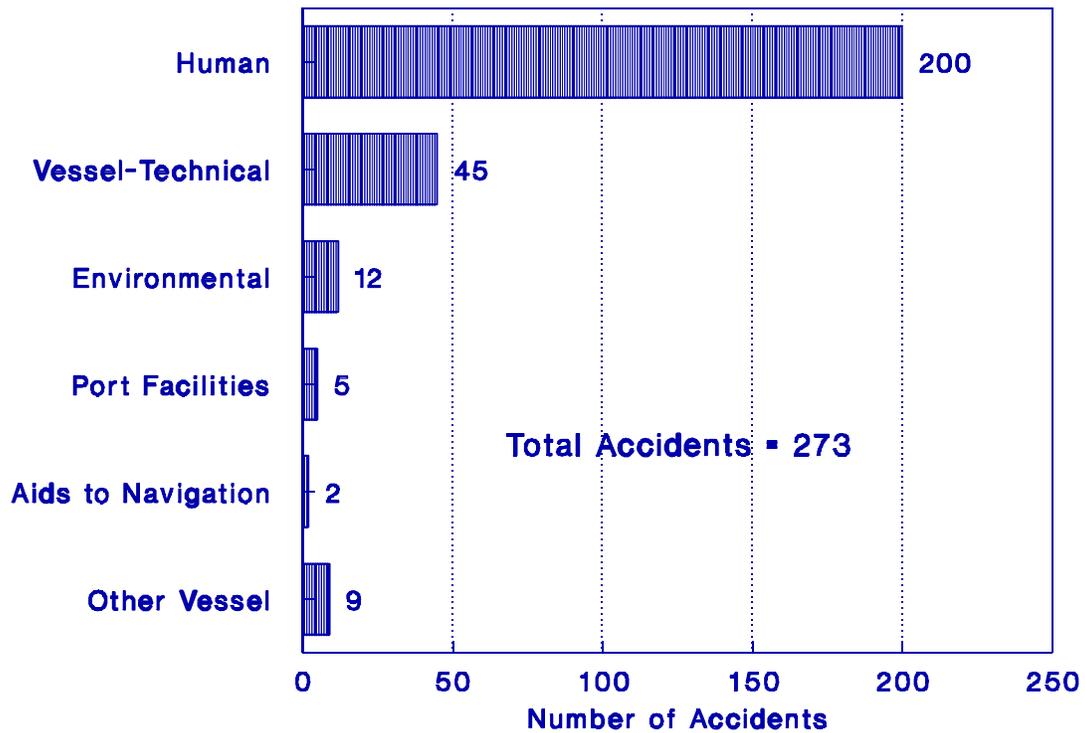


Figure 1
Contributing Factors

As shown in Figure 2, of the 200 accidents identified as involving human factors, 84 (42%) involved misunderstanding between pilot and master, inattention by the pilot or the officer of the watch (OOW) or a lack of communication between the pilot and the OOW. In addition, 91 (46%) involved misjudgment by the pilot or master. Breakdowns in communication or teamwork on the bridge appear to be implicated in many of these marine occurrences.

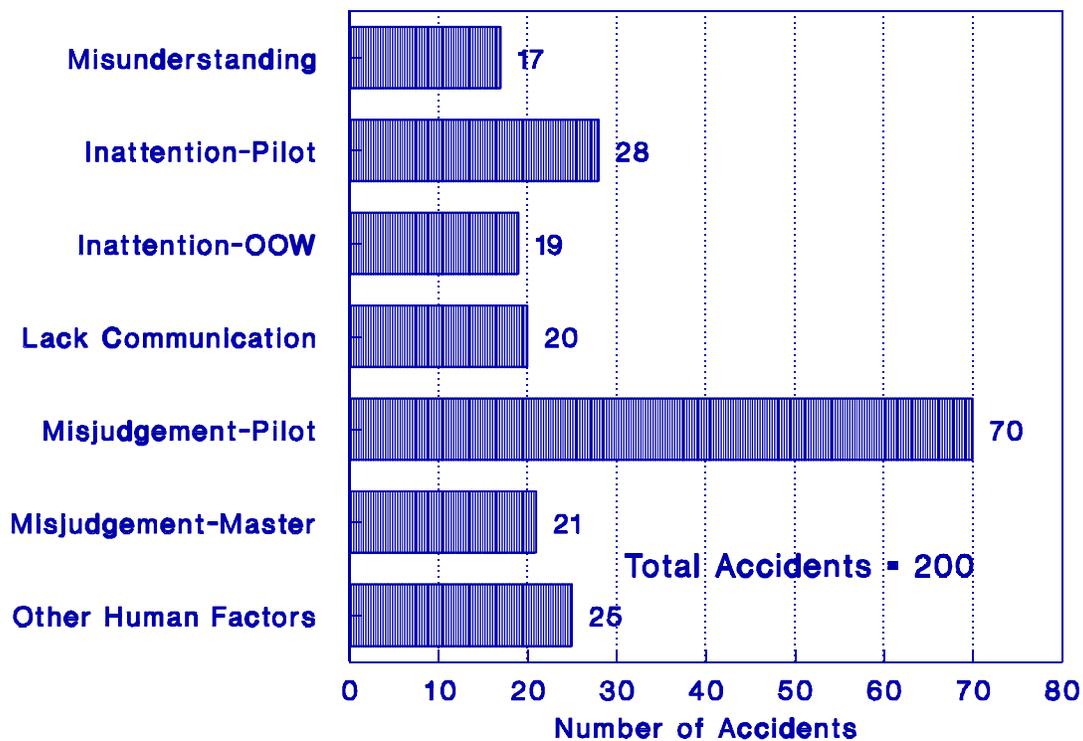


Figure 2
Human Factors

The high number of factors in Figure 2, identified as being associated with pilots, should not be surprising since, in all 200 accidents, the vessel was under the conduct of a pilot at the time.

As a result of its preliminary examination, the Board decided to study the conditions or practices which lead to such breakdowns, with a view to identifying safety deficiencies.

1.2 Objective

The objective of this safety study is to identify safety deficiencies associated with teamwork on the bridge, including communications between marine pilots and masters/OOWs.

1.3 Scope and Methodology

This study examines the operational relationship between pilots and masters/OOWs on Canadian and foreign vessels over 5,000 gross registered tons that are under the conduct of pilots in Canadian pilotage waters.

Behaviour in a complex operational setting, such as the bridge of a ship, is the product of several influences, such as regulations, rules, training and experience. Personal attitudes also shape behaviour, making particular responses in different circumstances more difficult to predict and evaluate. Therefore, information was needed on the prevalent attitudes, behaviour and interactions among marine pilots, masters and watchkeeping officers. Since only a limited amount of this attitudinal information was available from TSB occurrence files, a standardized questionnaire was developed to facilitate statistical analysis, comparison and contrasting of groups of respondents and the drawing of inferences from the sample to the marine population at large.

Interviews were conducted with representatives of Canada's four pilotage authorities, members of the international and domestic shipping industry and the Coast Guard to identify issues relevant to the interaction among bridge personnel. Questionnaire items were developed to gather more information on these issues. A draft questionnaire was produced and distributed to those in the marine industry perceived as having an interest for comment. Following the receipt of comments, the questionnaire was finalized and distributed to masters, OOWs and pilots.

The questionnaire consisted of 20 multiple-choice questions. Since it was important that respondents provide answers based on their own experience and behaviour (rather than simply reiterating what the rules and regulations require), each question began with the prefix "In my experience...." To give respondents an opportunity to expand upon or explain their answers and to bring attention to other issues, space was provided on the questionnaire for written comments. In addition, an open-ended invitation to all respondents sought comment on the operational relationship between pilots and masters/OOWs or suggestions which might advance marine transportation safety. The tabulation of the results of these questions is included in Appendix A.

Seven questions were designed to collect demographic information to help define the respondent sample and assist in statistical analysis of the results. A summary of the demographic information is included in Appendix B.

The questionnaire was distributed to 1,300 individuals, including pilots, masters and ship officers. Some 324 questionnaires were returned which represents 25% of the total questionnaires sent. Of the 324 responses, 130 (40.1%) were from pilots, 142 (43.8%) were from masters and 52 (16.1%) were from bridge officers. The above samples are statistically adequate to draw some conclusions about these three segments of the marine community. The demographic profile of the respondents corresponds well with the population profile although the west-coast representation is low. However, since the statistical characteristics of samples this size are stable, a larger number of respondents would make an appreciable change in the results only if those responses were extreme.

After the responses to the questionnaire were received, 34 supplemental interviews were conducted in the Atlantic, Laurentian and Great Lakes pilotage regions with masters and pilots, representatives of government, pilotage authorities, unions, shipowners and ship operators to assist in understanding comments received and in interpreting the results.

In the light of the experiences reported in the questionnaire responses, recent marine occurrences were reviewed. The proceedings of selected symposia and conferences, marine journals and periodicals, foreign marine safety studies, reports, recommendations and practices relating to marine pilotage were also reviewed to help relate the Canadian experience to the international situation.

A draft of the study, without recommendations, was provided to organizations in the marine industry for comment. These organizations included pilotage authorities, pilots' corporations, associations representing pilots, masters, bridge officers and shipowners, as well as Transport Canada. The comments received have been reviewed and the report has been modified, including the addition of safety recommendations.

2.0 THE MASTER/PILOT RELATIONSHIP

...Perhaps attitudes must change. Things have come a long way in this industry, but co-operation is still lacking between bridge officers, masters and pilots. --- a master²

Some masters just want to be masters, smirk at advice, and treat you as an intruder. --- a pilot

The Pilotage Act of 1972 (the Act) established four pilotage authorities (Atlantic, Laurentian, Great Lakes and Pacific) as Crown Corporations responsible for all aspects of pilotage in the waters under their jurisdiction. Pilotage authorities are responsible for establishing compulsory pilotage areas, the licensing of pilots and pilotage certificate holders and the provision of related pilotage services.

In compulsory pilotage waters, pilots provide local knowledge of the navigation conditions prevailing in the area. The pilot is responsible to the master solely for the safe navigation of the vessel. The master retains overall responsibility for the safety of the vessel but relies on the pilot's local knowledge and ability to handle the vessel in a safe and efficient manner. Cooperation between pilot and master is essential.

The International Maritime Organization (IMO), in a recommendation ratified by Canada and included by the Canadian Coast Guard (CCG) in its Recommended Code of Nautical Procedures and Practices, describes a navigational watch with a pilot on board as follows:

Despite the duties and obligations of a pilot, his presence on board does not relieve the master or officer in charge of the watch from their duties and obligations for the safety of the ship. The master and the pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics. The master and officer of the watch shall co-operate closely with the pilot and maintain an accurate check of the ship's position and movement.³

Navigating a vessel safely requires teamwork and interpersonal communications and this is particularly true in compulsory pilotage waters when a pilot is on board. The TSB examined the Canadian experience with respect to these issues by asking questions about three particular elements of the operational relationship between pilots and bridge officers, namely:

² Unless otherwise identified, all quotations are comments that were included in returned questionnaires.

³ IMO International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW), Regulation II/1, paragraph 10.

- i) the sharing of information such as passage plans and the vessel's condition, and the factors affecting communication;
- ii) the monitoring of the vessel's movements by the master and/or OOW while she is under the conduct of a pilot; and
- iii) the attitudes and behaviour on the bridge relating to teamwork.

Each of these three elements of the operational relationship is examined in the sections that follow.

2.1 Communication

Most foreign ships that I go on board totally rely on the pilot for the safe passage of the vessel and also the docking and do not question what is taking place either relating to speed or steering. --- a pilot

Encourage pilots to discuss their intentions with the OOW throughout the voyage. --- an OOW

Most marine organizations around the world recognize the importance of communications among members of the bridge team, including those times when a pilot is on board.

The Nautical Institute of the UK, in its guide to Bridge Team Management, states that:

Ideally, the Master and his team will be aware of the pilot's intentions and be in a position to be able to query his actions at any stage of the passage. This can only be brought about by:

- 1 The bridge team being aware of the difficulties and constraints of the pilotage area.
- 2 The pilot being aware of the characteristics and peculiarities of the ship.
- 3 The pilot being made familiar with the equipment at his disposal and aware of the degree of support he can expect from the ship's personnel.

The International Chamber of Shipping, in its publication Bridge Procedures Guide, recommends the following checklist to ensure an information exchange between master and pilot:

1. Has a completed pilot card been handed to the pilot?
2. Has the pilot been informed of the location of lifesaving appliances provided for his use?
3. Have the proposed passage plan, weather conditions, berthing arrangements, use of tugs and other external facilities been explained by the pilot and agreed with the master?
4. Is the progress of the ship and the execution of orders being monitored by the master and the officer of the watch?

As previously reported, the CCG states that:

The master and the pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics.

The importance of establishing positive communication when a pilot comes on board is recognized by most pilots, masters and OOWs. It was reported by pilots during interviews that most deep sea ships have a well established routine to welcome the pilot on board. A ship officer is assigned to meet the pilot at the gangway and to escort him to the navigation bridge where he is introduced to the master. Unfortunately, on some ships, the exchange between the pilot and the master is limited to a handshake. According to pilots interviewed, an increasing number of foreign masters consider the arrival of a pilot on board as a relief, a way to discharge some of their responsibilities, a chance to get some rest. Some of these masters will come back to the bridge only to sign the pilot's card on his departure.

Pilots and masters agree that improving communication among bridge personnel is the key to safer marine operations and to a better understanding of each others' duties and responsibilities.

The TSB questionnaire asked whether communications between pilots and bridge personnel are effective. Some 81% of masters, 85% of bridge personnel and 85% of pilots responded that communications are "always" or "often" effective. However, the responses to questions about the communication of specific information do not agree with this overall view of the effectiveness of communications.

Another question asked whether the pilot makes sure his orders are understood and acknowledged by the OOW. While 84% of pilots responded that they "always" do, 50% of masters and 50% of OOWs agreed that the pilots "always" make sure their orders are understood and acknowledged by the OOW.

As can be seen from this response and as will be seen from other responses, there are differences in the perceptions reported by masters/OOWs and the perceptions reported by pilots with respect to specific aspects of their operational relationship. These differences might result from the fact that the pilots and masters do not always share a common idea of what is required. While each group generally believes that it is providing adequate information, the other group might want more detailed information; the fact that both groups feel they are not getting enough information is evidence that draws into question the effectiveness of the communication.

When asked whether the OOW asks for clarification if he becomes unsure of the pilot's intentions, over 90% of OOWs responded that they "always" or "often" ask for clarification. About 76% of masters responded that OOWs "always" or "often" seek clarification. Conversely, 39% of pilots believe the OOWs "always" or "often" ask for clarification.

When asked whether bridge officers are reluctant to question a pilot's decision, some 92% of masters and 81% of bridge officers stated that, at least "sometimes", the bridge officers are reluctant; 11.5% of bridge officers replied that they are "always" reluctant to question the pilot's decisions. One master commented that, since the master is often on the bridge when a pilot has the con, the bridge officers will hesitate to speak up, probably relying on the master's experience and authority. Another master stated:

We often take the pilot's word as gospel failing to realize that he is there as an advisor only.

On 12 May 1991, the loaded Yugoslavian bulk carrier "MALINSKA" departed Hamilton, Ontario, bound for the intermediate port of Sorel, Quebec. At about 0033 on 13 May, the vessel ran aground approximately 20 miles south-south-west (SSW) of Kingston, Ontario, after altering course south of Main Duck Island. The TSB determined that the "MALINSKA" ran aground because the vessel did not establish with certainty the position and track, prior to, upon or after altering course off Main Duck Island. The Board stated that "a general lack of interaction, coordination, and cooperation among the master, the officer of the watch and the pilot was evidenced in this occurrence." The Board found that there was a lack of communication between the pilot and the OOW regarding the charted midnight position. Both the pilot and the second mate did their own calculations of the vessel's position, but they did not exchange information. (M91C2009)

One pilot summed up the requirement for an exchange of technical information as follows:

Pilots should be informed of each significant factor which may affect his proposed manoeuvring plan. Vessel manoeuvring characteristics should be shown to the pilot and he should ensure he understands any special conditions which may affect him. He should always know who the senior officer of the bridge party is, including the master and be aware of watch changes, quartermaster changes etc. Similarly the pilot must inform the master of his intended manoeuvring plan and update this as necessary with any change in conditions. Local regulations and communications requirements should be relayed to the master and officer of the watch.

The sections following examine the exchange of specific information necessary for the safe conduct of a vessel.

2.1.1 Manoeuvring Characteristics of the Vessel

When asked if the master or OOW informs the pilot of the manoeuvring characteristics of the vessel, 75% of masters and 71% of bridge officers stated that they "always" inform the pilot; in contrast, only 19% of pilots claimed that they were "always" informed of the vessels manoeuvring characteristics. Several pilots commented that the information was always available when they

asked for it, and two pilots noted that the information is less likely to be provided routinely on Canadian vessels than on foreign vessels.

Pilots are aware that there might not always be well established procedures for the exchange of information between the pilot and master. Most of the time, the pilot has to question the master or OOW to obtain essential information regarding the speed and manoeuvrability of the vessel. However, some pilots are reportedly reluctant in their willingness to offer information to ship masters; some masters and OOWs claim that the pilot, once on the bridge, seldom has time to refer to charts and provide details to the OOW, as he is occupied in conducting the vessel.

Canadian shipowners and operators expressed their opinions that their vessels' manoeuvring characteristics are well known to the Canadian pilots and that the master rarely has to provide information concerning the ship handling characteristics. Such cannot be said for foreign vessels.

Some masters stressed that it is typical of pilots anywhere in the world to provide little information to the bridge officers and to act as if taking over the vessel. It seems that few masters have at hand a specific table of their ship's characteristics to give to the pilot, as recommended by the International Chamber of Shipping⁴. They claim that the pilot may not have time to read the card, that he will have to leave the bridge at night to peruse it in order to find the particular information needed. They indicate that verbal communication is much more effective and tends to establish contact between the bridge personnel. Masters claim that, as a safety measure before berthing the vessel, they always provide the pilot with ship handling data, and that, if the pilot neglects to brief them on his intended manoeuvres, they will ask for details.

It appears that both groups recognize the safety value of providing information on the manoeuvring characteristics of the vessel to the pilot but are operating on the basis that, if it is required, it will be provided. Both groups might benefit from exposure to the attitudes and needs of the other group.

2.1.2 Local Conditions

When asked whether pilots provide information on local conditions to the master, a difference in the perceptions of the groups again is evident. Some 64% of pilots claim that they "always" provide the information, but only 26% of masters and 31% of bridge officers agree that the pilot "always" provides the information.

Pilots felt that masters of foreign vessels who were regular visitors in Canadian waters know the pilotage waters. Unless there has been a change in the aids to navigation system or special berthing manoeuvres have to be attempted, there is no need for them to brief the masters on the details of the transit. However, docking pilots and harbour pilots stated that they always brief

⁴ Bridge Procedures Guide by International Chamber of Shipping, 1990.

masters on their intended manoeuvres. In addition, they normally inform the master of the ship of the Harbour Master's docking instructions.

This perception that the masters and OOWs know well the local conditions and routines can lead both pilots and ship officers to take a lot for granted. Both groups can assume that they share a common mental model of the area and the plan, without having to review it together. This situation can lead to the bridge personnel and the pilot surprising each other. In a dynamic situation, this can easily get out of hand. One person assuming that another shares the same assessment of a situation can take action which the other does not expect. This places both of them in a difficult situation. Misunderstandings can build on each other, destroying mutual support or teamwork, and even leading to conflict. Prior discussion and agreement on the plan and mutual acceptance of duties and responsibilities, however, will usually foster teamwork.

2.1.3 Manoeuvring and Passage Plans

On 08 May 1991, while downbound in the St. Lawrence River with a cargo of oil, the Canadian tanker "IRVING NORDIC" struck bottom to the north of the ship channel, downstream of the Grondines wharf. The TSB determined that the "IRVING NORDIC" struck bottom because the vessel left the navigation channel as a result of a premature alteration of course. The alteration of course was ordered by the pilot who believed that the "IRVING NORDIC" was farther downstream than the vessel really was. The helmsman did not advise the pilot that he was experiencing difficulty in holding the vessel on course. The pilot did not question the helmsman about the position of the wheel relative to the rudder angle indicator. The OOW's method of monitoring the vessel's progress was not sufficiently precise to prevent the occurrence. The Board stated that a general lack of interaction and coordination between bridge personnel and the pilot contributed to the accident. (M91L3012)

In its report, the Board, discussing the errors that resulted in the vessel striking bottom, stated:

In confined compulsory pilotage waters, a pilot's passage plan containing all key navigational elements such as course alteration points, wheel-over positions, and points where the accuracy of position fixing is critical, etc. could reduce the risk of such errors.

On 01 July 1991, the loaded Great Lakes bulk carrier "HALIFAX" grounded in the same area, also due to a premature alteration of course. The Board found that the vessel's position was not double-checked with all available landmarks and navigation aids. The OOW was not monitoring the pilot's actions and did not recognize that the change of course was premature. The OOW appeared to have placed total confidence in the pilot's navigation ability. When the pilot passed his position report to VTS, the OOW logged the time, but he did not plot the position on the chart. Had the OOW been using a recognized, precise method of monitoring the vessel's progress, he might have been able to recognize the pilot's error and question the change-of-course order before it resulted in the grounding. The Board stated that there was no effective exchange of navigational

and operational information (including passage planning) between the officers of the ship and the pilot. (M91L3015)

Pilots say that they do a good job of establishing effective relationships by sharing information on local conditions and plans. The masters and bridge officers, however, do not endorse the pilots' assessment of their own efforts. Several pilots qualify their survey responses in their written comments saying that they provide complete information when it is needed or requested. The implication is that, much of the time, pilots believe that it is not needed or requested. In fact, some pilots complain that, as soon as they take the con, masters often take advantage of their presence to leave the bridge to get some sleep.

When masters and pilots were interviewed, they confirmed that there is little exchange of information on board. They assume that the other party knows the necessary information; otherwise, they expect that the other party will take the initiative to ask for the information. When asked whether the pilot informs the master of his manoeuvring plan for the vessel, less than half (48.5%) replied that pilots "always" or "often" inform them of the manoeuvring plan. Almost 80% of pilots claim that they do.

Pilots commented that they always provide the plan unless it is a routine manoeuvre. Others said that they provide the information when they are asked.

When asked whether the master ensures that the pilot's passage plan and local conditions are suitable for the vessel, about 83% of masters claim that they "always" or "often" ensure that the pilot's plan and local conditions are suitable for the vessel. Only 37% of pilots agree with this.

It is possible that the master reviews and approves the pilot's passage plan, or what he assumes, on the basis of experience, to be the plan, without communicating this to the pilot. The pilot assumes that, if there are no objections, there are no problems. One pilot stated:

Truth be known, this is one area which must be improved upon as 'familiarity breeds contempt'.

When the masters and bridge officers were asked whether pilots offer all necessary information regarding the pilotage and manoeuvring plans for the vessel, 25% of masters and 29% of bridge officers replied that the pilots "always" provide the necessary information. Some 30% of masters and 38% of officers replied that the pilots "often" provide the information.

Foreign masters who are not familiar with local navigation conditions rely largely on the pilots and the verification of the pilot's passage plan becomes only a formality. At the same time, Canadian masters who are well aware of the local conditions may also pay little attention to the pilot's passage plan.

In its report of the "IRVING NORDIC" occurrence, the Board stated the following about passage plans:

Knowledge of the pilot's passage plan would provide a focus for the OOW to effectively monitor the intentions of the pilot, the track and the progress of the vessel. Currently, it is not common practice for pilots to provide passage plans to ship's personnel or for the pilotage authorities to provide such plans to their pilots.

The Board went on to recommend that:

The Department of Transport require that the pilotage authorities publish official passage plans for compulsory pilotage waters and make them available to masters to facilitate monitoring of the pilot's actions by the vessel's bridge team.

(TSB Recommendation No. M94-34, December 1994)

In its reply dated 22 March 1995, the Department of Transport did not accept the recommendation, stating that the Pilotage Act does not provide for the Department of Transport to require the pilotage authorities to take action of the nature proposed.

The Department further stated:

It is the Authorities' and Department's view that piloting, by its nature, is a process requiring the pilot to constantly adjust to changing conditions throughout the voyage. Course alteration points and wheel-over positions depend on a number of variables including the vessel's initial position, its speed, turning characteristics which vary according to its state of loading and trim, wind speed and direction, tidal flow and current, weather and ice conditions, limiting water depths and underkeel clearance, and other traffic in the generally restricted waterways concerned. All of these factors cannot be foreseen in advance and a passage plan is therefore viewed as being of limited, if any, practical value.

The Board is aware that, due to the dynamic nature of piloting a vessel, there will invariably be deviations from any detailed manoeuvring and passage plans. However, that is not to say that the pilot should not discuss with the master or OOW his intentions for the conduct of the vessel. Such communication of intentions, be it in the form of a detailed or a general passage plan, could assist the OOW, particularly in restricted waters, to monitor and verify clearing bearings and radar safety ranges and contribute to the safety of the passage.

2.1.4 Hand-over Briefings

Masters are often unaware of the local conditions and pilots are often unaware of the manoeuvring characteristics of the vessel. Therefore, hand-over briefings are essential so that both the master, having responsibility for the safety of the vessel, and the pilot, having responsibility for the conduct of the vessel, will be aware of all relevant factors which might affect the safe navigation of the vessel.

On 05 August 1990, after unberthing in the Port of Montreal and attempting to turn the vessel to head downstream, the chemical tanker "LAKE ANINA" grounded outside the channel over a pipeline buried in the river bed. The TSB determined that, while in a compulsory pilotage area with a pilot on board, the master retained the conduct of the vessel. The master believed that he was better suited to carry out the manoeuvre because of his familiarity with the vessel, and he was counting on the pilot's advice during the manoeuvre. However, the master and the pilot had different ideas as to the helm and engine actions required to effect the turn. In this case, the master's ideas prevailed. The type and degree of support and advice to be given by the pilot were not determined in advance. (M90L3016)

In its report of this occurrence, the Board stated:

An exchange of all relevant information and the intended transfer of the conduct of the vessel should also be established and agreed upon as soon as possible.

Hand-over briefings are an essential component of teamwork and cooperation. However, here again, there is a different perception between pilots and masters/bridge officers on the conduct of hand-over briefings. When asked whether informative hand-over briefings, master-to-pilot, pilot-to-pilot and pilot-to-master, are carried out, 77% of masters, 90% of bridge officers, but only 40% of pilots replied that such briefings were "always" or "often" carried out; 5% of pilots stated that hand-over briefings were "never" carried out.

2.1.5 Radio Communications

Masters and bridge officers were asked whether they are apprised, by the pilot, of all safety communications regarding the navigation of the vessel in pilotage waters. Some 62% of masters and 62% of bridge officers replied that they were "always" or "often" apprised by the pilot.

When asked whether pilots ensure that relevant communications with Vessel Traffic Services or other vessels are conveyed to them, 54% of masters and 54% of bridge officers replied "always" or "often". Some 9% of masters did reply that such communication was "never" conveyed to them.

When pilots were interviewed, they contended that all communications relating to the navigation and safety of the ship were conveyed to the master/OOW.

2.1.6 Language

The only practical way to improve operation relationship is to improve communication between pilots-masters-officers of the watch. This can be by one common language internationally.... As standards of crewing have yet to see a real positive improvement, this problem will be ongoing until the shipping world exhausts the search of nations for ever cheaper crews. With the introduction of a new nation/language, the communication problem exists with these new conscripts for three to five years until they have attained a reasonable level of language expertise, they then become more expensive and so the cycle continues. --- a pilot

An increasing number of foreign vessels plying Canadian waters are reported by pilots as having no one on board who can speak English or French. In fact, since 1975, there have been at least 24 marine occurrences involving foreign-flag vessels in Canadian waters where an inadequate knowledge of the operating language was identified as a contributing factor.

When pilots were asked whether language barriers make it difficult to communicate orders to the helmsman on foreign-registered vessels, some 60% replied that language barriers "sometimes" affect communication with the helmsman while 20% reported that it "often" resulted in difficulty in communicating.

When pilots were asked whether language barriers prevent an effective exchange of information with the master and the OOW on foreign-registered vessels, almost 55% replied that language barriers "sometimes" prevent effective communication with the master and the OOW and 23% stated that language barriers "often" prevent it.

When interviewed, pilots expressed concern that, due to the increase in the manning of foreign vessels by crews from Third World countries, more communication difficulties would be encountered. On some foreign ships, the crew members can originate from several countries, and have communication difficulties among themselves. For example, on the British Columbia coast, a cruise vessel had a crew consisting of 24 nationalities, and it is reported that it is not unusual for cargo ships to have 8 or 10 different nationalities among the crew.

Many foreign ships now carry masters and officers who have practically no knowledge of English or French, rendering communications very difficult and requiring continuous surveillance by the pilot to ensure that orders are interpreted and carried out correctly. The pilot is often left on the bridge with one officer and a helmsman and, at times, none of them can understand the others. The pilot then has no choice but to stand by the helmsman to make sure his orders are executed correctly. In addition, the pilot effectively becomes the Communications Officer, dealing with Vessel Traffic Services. These factors detract from the pilot's ability to give his total attention to the safe navigation of the vessel.

Pilots stated that the major problem in pilotage anywhere in the international scene is the language barrier. They could not see how the language problem could be solved in the near future. They fear that it will again be a case of the marine industry experiencing accidents before any positive action is taken and regulations implemented.

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW) requires officers in charge of a navigational watch, on vessels of 200 gross registered tons or more engaged in international voyages, to have an adequate knowledge of the English language. Despite this requirement and the demonstrated inability of some watchkeeping officers to converse in or to understand English, many IMO Member States continue to issue certificates of competency to individuals with substandard proficiency in the language.

An IMO Maritime Safety Committee (MSC) memorandum on the "Role of the Human Element in Maritime Casualties", submitted by the government of the Bahamas, states:

It should be noted that in the Act, if the crew have insufficient knowledge of English and do not have a common language, the ship shall be deemed unseaworthy and shall not proceed to sea.

In its report of the collision on 22 July 1991 between the "TUO HAI" and the "TENYO MARU" (M91W1051), the Board stated:

The Board believes that, for international shipping, a working knowledge of the English language for safe navigation is necessary to use nautical publications, to understand meteorological and safety messages, and to effectively communicate with other vessels or shore stations. The Board is concerned that the inability of mariners to effectively communicate safety information continues to contribute to serious occurrences.

The Board went on to recommend that:

The Department of Transport, working through the International Maritime Organization, seek stronger international measures to ensure that Member States, when issuing certificates of competency, adhere to the standard of language knowledge prescribed by the STCW.

(M95-01, issued April 1995)

In its response to this recommendation, the Department of Transport stated its agreement with the intent of this recommendation.

2.2 Monitoring of the Vessel Movements

On 16 April 1993, the fully loaded "CANADIAN EXPLORER" was upbound in the St. Lawrence River under winter navigation conditions. The vessel touched bottom on the south side of the channel off Lotbinière, Quebec. The TSB determined that the contributing factors of the occurrence were that the pilot fell asleep and neither the pilot nor the OOW effectively monitored the vessel's progress in an area of strong current. The practice of OOWs relying on pilots and rarely questioning a pilot's actions is quite widespread. The procedures in place on the bridge allowed the pilot and the OOW to operate independently. The opportunity for teamwork to maximize performance was not exploited. A greater degree of interaction between the pilot and the OOW could have resulted in the effective monitoring of the vessel's progress. It also could have alerted the OOW to potential problems and might have enabled him to initiate appropriate action. (M93L0001)

In addition to the "CANADIAN EXPLORER", the previously mentioned occurrences involving the "IRVING NORDIC", the "MALINSKA" and the "HALIFAX" also clearly demonstrate the consequences of the OOW not monitoring the vessel movements.

When asked whether the OOW monitors the vessel movements when the pilot has the conduct of the vessel, some 96% of OOWs replied that they "always" or "often" monitor the ship movements. The replies from masters agreed; 95% stated that the OOWs "always" or "often" monitor the vessel movements. Pilots, however, were less certain; only about 50% of them believe that OOWs "always" or "often" monitor the vessel movements.

The same results were evident in the response to the question which asked whether the OOW plots the vessel's position regularly when the pilot has the conduct of the vessel. Approximately 90% of masters and bridge officers replied that the OOW regularly plots the ship's position, but only 49% of pilots agreed.

When asked whether the pilot assists the OOW in monitoring the vessel movements, all three groups agreed that generally pilots do not assist in this function. Some 44% of pilots said that they "sometimes" assist and 11% said that they "never" assist.

Again, there are differences between foreign and Canadian vessels. OOWs on foreign vessels are more likely to monitor movements and plot positions than OOWs on Canadian vessels. As well, pilots note that there is little use in plotting positions in restricted areas and narrow channels as in the Seaway. One pilot wrote that, in his experience, OOWs are most likely to plot positions after the pilot has changed course. One master comments that, although OOWs should monitor the vessel movements, some have become remiss in this duty.

When interviewed, pilots affirmed that there are few vessels whose OOWs monitor the pilot, plot the vessel's position regularly or ask questions if they are not comfortable with the action taken. Pilots express a sense of being alone and solely responsible when on the bridge of some ships and stated that most officers do not bother to plot the vessel's position but simply ask the pilot for the position at the end of their watch, in order to pass it over to the next OOW. Many feel that they

are not being supported or monitored by the bridge personnel. The bridge officers, however, claim that they do monitor the ship's progress and plot positions on the chart.

In its report of the "IRVING NORDIC" occurrence, the Board stated the following about monitoring the vessel's progress:

The Board believes that close and continuous monitoring of a vessel's progress along the pre-planned track is essential for the safe conduct of the vessel.

2.3 Teamwork

On foreign-registered ships... I have had several incidents when the Captain gave the helmsman different orders than I gave him. I can tell by the rudder indicator. (In other words he is second-guessing my judgement.) Over the last 23 years, this has nearly caused some collisions and grounding. Also with a variable pitch propeller I have had different orders relayed for engine movement while manoeuvring the ship. Again second guessing my judgement/ability - a very dangerous action - creating confusion on the bridge. On several occasions the master has said it was "Pilot error" - not so in my case - now I carry a tape-recorder to protect myself. --- a pilot

Ineffective communications on the bridge, interrupted procedures, lack of situational awareness, lack of teamwork between pilots and ship officers, etc. have been contributory factors in several similar occurrences in recent years. The following extracts from TSB reports are representative of occurrences in which there were serious lapses in teamwork among the bridge officers:

A general lack of interaction, coordination, and cooperation among the master, the officer of the watch and the pilot was evidenced.... There was no effective exchange of navigational and operational information among the different crew members and the pilot when they came onto the bridge around midnight. Both the pilot and the second mate did their own calculations of the vessel's position, but they did not exchange information.... Because he did not know what the pilot's intentions were, the second mate did not question him....

("MALINSKA" - M91C2009)

In compulsory pilotage areas of the St. Lawrence and Saguenay rivers, there have been several serious occurrences where masters took the conduct of their vessels while a licensed pilot was on the bridge.... In all these occurrences, there was ineffective communication as to the master's intention of taking over the conduct of the vessel.... The intended transfer of the conduct of the vessel should be established clearly and unambiguously before commencing a critical manoeuvre.... The Board is concerned about the extent to which lack of teamwork, lack of local knowledge and poor master/pilot communications on the bridge are contributing to such occurrences....

("ENERCHEM FUSION" - M90L3011)

Once again, a general lack of interaction and coordination between the bridge personnel and the pilot contributed to this marine accident. There was no effective exchange of navigational and operational information (including passage planning) between the officers of the ship and the pilot....

("IRVING NORDIC" - M91L3012)

In this occurrence, the exchange of information between the pilot and the master was apparently ineffective; consequently, neither was aware of the other's intentions.... For a bridge team to function as a coherent system, the role of the pilot, and the type and degree of support he can expect from the vessel's personnel and vice versa must be unambiguously established when the pilot comes aboard. An exchange of all relevant information and the intended transfer of the conduct of the vessel should also be established and agreed upon as soon as possible.

("LAKE ANINA"- M90L3016)

... a general lack of interaction, coordination, and cooperation between the master, the officer of the watch and the Canadian pilot contributed....

("CONCERT EXPRESS" - M92M4023)

2.3.1 Factors Affecting Effective Teamwork

Personal Attitudes

Pilots, masters and bridge officers generally agree that teamwork is as important as technical proficiency for safe navigation. Some 96% of masters, 100% of bridge officers and 85% of pilots stated that teamwork was "always" or "often" as important as technical proficiency. One master commented that "You can't have one without the other."

When pilots were asked if it is possible to establish an effective working relationship with the master and OOW, 47.7% said it was "always" possible and 36.2% said it was "often" possible. However, when questioned about their experience with the master, OOW and pilot working as a team, 50.7% of masters, 46.2% of bridge officers and 37.7% of pilots stated that they "always" worked as a team.

The following comments from respondents are illustrative of the views of masters and pilots towards the current levels of bridge teamwork:

... Some form of Bridge Resource Management (BRM) is certainly necessary and in fact it does exist today but it is not formalized and varies from ship to ship.... What can be "managed" depends on what resources are available to begin with and these are subject to such variables as the type of ship, crew nationality, organization, competence and language facility. --- a master

... on many Canadian ships and some foreign ships that I assist, the Captain does most of the ship handling because he is used to his ship and uses the pilot for local knowledge and information pertaining to his berth. On these vessels, I find it is more teamwork compared to a lot of foreign vessels where the Captain just stands around as an observer and only gives instructions to his officers forward and aft. --- a pilot

These responses are common in operational settings where people are not trained or otherwise prepared to understand their own responsibilities and the needs of the other party. Pilots seem to assume that, if the master needs more information, he/she will ask for it. The ship officers similarly feel that the pilots prefer to be left to their own devices.

When a pilot embarks, a situation is created where two or more people are tasked to carry out a job together. If there is no discussion of the division of labour and responsibility, each will make assumptions about the attitudes and expectations of the other. Over time, these expectations can become the norm. The resultant changing attitudes, values and behaviours become part of the marine culture.

Corporate Perspective

Notwithstanding the evidence that poor teamwork on the bridge results in accidents, there appears to be some reluctance to acknowledge that improved cooperation between pilots and masters can result in safer navigation in pilotage waters.

For example, a representative of a pilots' corporation suggested that:

Even in the absence of cooperation among the personnel on the bridge in certain circumstances (no common language, among others), piloting a ship can very well be done safely through the professional knowledge of pilots. It would be dangerous to believe that safe navigation could be ensured solely by excellent cooperation among the personnel on the bridge or the technical proficiency of the master and the bridge officers.

Representatives of the Canadian Marine Pilots Association and the Canadian Merchant Service Guild (CMSG) stated jointly that the technical standards established to qualify as a pilot in the Canadian pilotage system are high. They further commented that courses in human factors have never been offered, and they are uncertain about the usefulness of such courses in improving bridge personnel interrelationships.

Although no direct link has been established, the cost of pilotage to shipowners is another issue which might have an adverse impact on the establishment of effective teamwork on the bridge.

Pilotage fees have been a source of conflict between shipowners and pilots' corporations. Representatives of shipowners have stated that Canadian lakers should not have to take on pilots at all times. They feel that pilotage unnecessarily increases costs and that masters, with the

assistance of their senior officers, could conduct their vessels safely anywhere in the St. Lawrence ship channel.

A pilot commented on the impact of corporate attitudes as follows:

The attitudes of bridge officers reflect the opinions of their companies. If pilots receive poor cooperation in ships of a particular company, the pilots will go aboard with a preconceived attitude which might not be conducive to a good operational relationship. Otherwise, if a boarding pilot is treated as another mariner and colleague there is no problem.

Notwithstanding the fact that shipowners and pilotage officials are striving to advance marine transportation safety, their different attitudes, arising from their different perspectives, can have the potential to compromise safety by influencing the attitudes of the members of the bridge team towards the need for and the benefits of effective bridge teamwork.

Training Requirements

The training for Canadian ship masters, pilots and ship officers concentrates on technical proficiency. The development of teamwork requirements and the definition of the qualities required to enhance working relationships among the persons responsible for the conduct of the vessel are practically non-existent in the study curricula.

Canadian ship masters and officers must satisfy Transport Canada certificate requirements as stipulated in TP2293⁵. However, the emphasis in the training syllabus is on navigation skills. Bridge teamwork when a vessel is under the conduct of a pilot is not taught.

Requirements for a pilotage licence vary between pilotage districts. However, in all districts, candidates must be holders of a Certificate of Competency as Master Home Trade or a Deck Officer certificate and ON I, according to Transport Canada's requirements. Candidates must also have completed a practical training period under the supervision of a licensed pilot, Simulated Electronic Navigation courses and general pilotage courses. Pilots are also periodically offered theoretical and practical courses to improve their ability in ship handling. There are no training curriculum requirements relevant to teamwork or Bridge Resource Management (BRM).

If masters, ship officers and pilots were exposed to training which would require discussion of all the information, plans, duties and responsibilities inherent in each other's tasks, cooperative and complementary teamwork would more likely result.

⁵ TP2293, The Examination & Certification of Masters & Mates - Publication EXN 1 (1979) by Ship Safety Branch, Canadian Coast Guard, Transport Canada.

It should be noted that steps are being taken to increase training in BRM. The Board is aware that the Atlantic Pilotage Authority, in conjunction with the Nova Scotia Nautical Institute, has developed a BRM course. In addition, Transport Canada is in the process of developing optional training courses on this subject.

Pilots' Liability

I believe that pilots should be accountable legally for their actions/manoeuvres/pilotage on the vessels they are on; this may increase the amount of information they forward on to the OOW as well as improve the working relationship. --- a master

Although the issue of the pilots' legal liability, as set out in the Pilotage Act, was not addressed in the questionnaire, several masters did comment on it.

Section 25 of the Pilotage Act defines the pilot's responsibility as follows:

A licensed pilot who has the conduct of a ship is responsible to the master for the safe navigation of the ship.

The pilot's liability is defined in Section 40:

A licensed pilot is not liable in damages in excess of the amount of one thousand dollars for any damage or loss occasioned by his fault, neglect or want of skill.

Section 41 then goes on to state:

Nothing in this Act exempts the owner or master of any ship from liability for any damage or loss occasioned by the ship to any person or property on the ground that

- (a) the ship was under the conduct of a licensed pilot; or
- (b) the damage or loss was occasioned by the fault, neglect, want of skill or wilful and wrongful act of a licensed pilot.

The following comments from masters are illustrative of their concern over this issue:

... I had one pilot get the vessel in a difficult position, tell me that we needed tugs. When I mentioned that we always go alongside unassisted by tugs, he walked out of the wheel house. I berthed the vessel after it was already in a difficult position. I am still responsible for the safety of the ship. Since pilots are not held accountable for their actions, it seems they should listen more to what the masters are telling them. Unfortunately, it's not happening. Pilots must remember that the Masters are much more familiar with the behaviour of their ship. They handled them every day.... I don't want to paint everyone with the same brush. I've had some excellent pilots aboard; informative, knowledgeable, cooperative. Unfortunately, it is not these gentlemen who stick in your mind....

In areas of compulsory pilotage, the responsibilities of pilots with regards to liability should be revamped so that the pilot assumes direct liability for his actions.

Hold the pilot responsible for his action when he is conning the ship. Why should a bridge officer lose his job or his certificate because a pilot falls asleep after being on the ship for only three hours? Only when the master or bridge officer disregards the advice of the pilot should the pilot be relieved of responsibility.

Although it is a concern to some masters, there is no indication that the pilots' limited legal liability is a factor in occurrences investigated by the Board or that it affects the working relationship between masters and pilots. Nonetheless, differing perspectives by bridge personnel on such fundamental concerns as pilot liability can create a barrier to effective communications among the team members.

2.3.2 Foreign Practices

Several organizations in the marine industry have recognized the relationship between vessel crew interaction and accident causation:

- The United States National Transportation Safety Board (NTSB) has cited the lack of proper crew interaction as being a factor in several marine occurrences and has made several recommendations to require Bridge Resource Management (BRM) training for deck watch officers on US-flag vessels. For example, the NTSB investigated the grounding of the "QUEEN ELIZABETH II" off Martha's Vineyard en route to New York in 1992, and concluded that, if the master and pilot had actually talked about the proposed course, the occurrence would probably have been averted. Both master and pilot underestimated the vessel's propensity to squat when cruising at 25 knots.

As a result of the 1989 grounding of the tanker "WORLD PRODIGY", the NTSB recommended that the U.S. Coast Guard require Bridge Resource Management (BRM) training for all deck watch officers of US-flag vessels over 1,600 gross tons. The NTSB again recommended BRM training for ship officers in March 1992 in connection with the 1990 grounding of the U.S. tank ship "CONNECTICUT".

- The United States Merchant Marine Academy and the Maritime Institute of Technology and Graduate Studies have developed BRM training programs and are currently offering them to the U.S. marine industry.

- A Swedish club mutual insurer has entered into an agreement with Scandinavian Airlines System and six maritime organizations to develop BRM training for ship officers in an attempt to reduce marine accidents.

- The Maritime Training and Research Centre in Toledo, Ohio, offers a formal training program in Vessel Resource Management. This training seeks to ensure a higher degree of crew integration, coordination and communication among experienced mariners than has been the maritime tradition. Each class is required to develop unique applications to error trapping, briefing and passage planning, ongoing coordination and communication, and synergy in decision making.

In an effort to improve marine safety, the American Pilots Association (APA) is recommending that its members take a course to help them communicate better with foreign crew members. In 1993, the APA's Board of Trustees also called for pilot associations to provide BRM courses for their members and trainees and for licensing authorities to require the courses as a prerequisite to receiving and renewing a pilot licence. Further, a unanimously adopted measure recommends refresher courses at least every three years.

3.0 SUMMARY OF FINDINGS

1. In the 273 occurrences examined in this study, misunderstanding between the pilot and master, inattention by the pilot or the OOW, or lack of communication between the pilot and the OOW were frequently present.
2. The complexity of the master/pilot relationship was highlighted by the often conflicting opinions given by masters, OOWs and pilots in response to the TSB's questionnaire.
3. The vast majority of responding masters, bridge officers and pilots believe that teamwork is as important as technical proficiency for safe navigation.
4. Recent occurrences indicate continuing problems with respect to the adequacy of bridge teamwork; e.g. lack of a mutually agreed passage plan, lack of interaction, coordination and cooperation among the bridge team, lack of precise progress-monitoring by the OOW, etc.
5. Fundamental differences in the corporate perspectives of ship officers and pilots on such issues as the need for compulsory pilotage and limited pilots' legal liability are not conducive to promoting harmony in bridge teamwork.
6. Although most pilots, masters and OOWs agree that improving communications among bridge personnel is key to safe marine operations, a significant proportion of masters and bridge officers reported reluctance to question a pilot's decisions.
7. Often, there are differences in perceptions between masters/OOWs and pilots regarding the need for the exchange of information and the adequacy of the information being exchanged.
8. Most masters and bridge officers who responded to the questionnaire state that they always inform the pilot of the manoeuvring characteristics of the vessel, but few pilots state that they are always provided with the information.
9. The majority of masters and bridge officers feel that pilots do not always provide adequate timely information on local conditions. Pilots reported that masters on foreign vessels who are regular visitors in Canadian waters know the local conditions well enough.
10. Many masters and bridge officers reported that pilots do not always provide information to the master or the OOW regarding the passage plan; most pilots claim that they do.
11. Pilots and masters also disagree over the adequacy of hand-over briefings; most masters/OOWs say that they are informative and most pilots say that they are not.

12. Many masters and OOWs believe that pilots do not always convey information essential to safe navigation which is received by radio communications.
13. With respect to the overall exchange of information between pilots and masters and OOWs, apparently each party is under the assumption that the other knows the necessary information and, if they do not, they will request it.
14. Misperceptions that the other party knows about the manoeuvring characteristics of the vessel, or the local conditions and the intended passage plan can lead to significant misunderstandings and surprises for the bridge team.
15. Since 1975, there have been at least 24 marine occurrences involving foreign-flag vessels in Canadian pilotage waters where an inadequate knowledge of the operating language was identified as a contributing factor.
16. A majority of pilots reported that language barriers "sometimes" prevent effective communication with the master and the OOW; several reported that language barriers "often" prevented it.
17. Pilots and bridge officers disagree on the extent to which OOWs monitor the vessel's progress, the pilots expressing some dissatisfaction with respect to how well they are being supported or monitored by bridge personnel. However, both groups agree that the pilots seldom assist the OOW in monitoring the vessel movements.
18. Most of the foregoing findings are indicative of serious barriers in the relationship among pilots, masters and OOWs, thereby compromising their effectiveness as a coherent team.
19. Several foreign organizations have recognized the relationship between crew interaction and accident causation, and have begun implementing various training regimes in Bridge Resource Management (BRM).
20. Training for Canadian ship masters, bridge officers and pilots concentrates on technical proficiency. No initial or recurrent training in bridge teamwork is required to retain a valid operating certificate in Canada.

4.0 RECOMMENDATIONS

4.1 Hand-over Briefings

The 273 occurrences examined at the outset of this study frequently involved lack of communications among the bridge team. TSB investigations of subsequent occurrences continue to show inadequate interpersonal communications among the bridge team.

The results of the questionnaire demonstrate that, with respect to the need for communication, there are differences in perceptions and expectations between pilots and masters/OOWs. It appears that, in the absence of effective communication and exchange of information, both groups are making assumptions about each other's plans and actions, or lack thereof.

In response to a general question about the effectiveness of communication, over 80% of each group agreed that communications are effective. However, when asked about specific information issues, respondents were less positive.

Helm orders and other information, when communicated, are communicated well. What is important, however, is the information which is not passed on routinely. The responses to the questionnaire as well as the accident record demonstrate that, in many instances, passage plans, vessel characteristics, and local conditions are not communicated effectively. Even when watchkeeping officers are unsure of a pilot's intentions, it appears that many are reluctant to ask. There are many reasons offered for the information not being communicated. Many believe that the handling characteristics of Canadian-registered ships are well known to the pilots. Pilots may believe that Canadian officers are familiar with the routes and standard passage plans, so it is not necessary to discuss them. Another probable factor is habit, or normal procedures. If pilots were regularly asked to brief on their passage plan, they would probably come to expect it and prepare a briefing routinely. Similarly, if pilots asked routinely for information about the ship and her characteristics, bridge teams would be prepared to provide it.

Normally, however, there is little information provided routinely and little apparent demand for it. Only when prompted on specific communication issues did either group comment unfavourably. In operational settings, people try to live up to expectations. It is obvious that neither pilots nor ship officers are expected to provide each other with much information, so they do not. If procedures which would encourage the exchange of information were implemented and enforced, it would become the norm over time.

Given the chronic absence of effective communications among bridge officers and pilots resulting in a taciturn operating culture, the fundamental differences in expectations of the two groups frequently contributing to a lack of mutual understanding, and the demonstrated consequences of such misunderstanding, strong measures are required to enhance bridge team effectiveness through enhanced information exchange. Clearly, the current provisions in the CCG Recommended Code of Nautical Procedures and Practices regarding the exchange of information

on "navigation procedures, local conditions and the ship's characteristics" are not being effectively applied. Therefore, the Board recommends that:

The Department of Transport require that, when a pilot commences duty in compulsory pilotage waters, there be a formal exchange of information between the master and the pilot with mandatory briefing elements for planned navigational procedures, local conditions and ship's characteristics.

M95-06

and that:

The Department of Transport ensure that training for Canadian ship officers and pilots include practice on the use of hand-over procedures to assist in the safe navigation of vessels in pilotage waters.

M95-07

4.2 Language

Language barriers on foreign ships continue to be a serious obstacle to the safe navigation of these vessels in pilotage waters. Since effective information exchange is vital to safe navigation, safety is compromised on those vessels where the pilots are unable to communicate with the crew. Not only do such language barriers lead to misunderstanding among the bridge team, but the bridge officers' situational awareness is compromised when they do not comprehend VTS or other radio communications and the pilot's workload is increased by the extra vigilance required in ensuring complete and timely compliance with directions.

The Board notes the agreement of the Department of Transport with the intent of recommendation M95-01, made in the report of the collision on 22 July 1991 between the "TUO HAI" and the "TENYO MARU". The recommendation stated that:

The Department of Transport, working through the International Maritime Organization, seek stronger international measures to ensure that Member States, when issuing certificates of competency, adhere to the standard of language knowledge prescribed by the STCW.

Accordingly, the Board is not recommending further safety action at this time. However, in view of the significance of this issue, as evidenced by the accident record and the comments received from parties in the industry, the Board continues to be concerned about the lack of adherence to the standard of language knowledge by Member States and will continue to monitor progress in this area.

4.3 Monitoring of Vessel Movements

Several recent occurrences might have been prevented had there been an effective regime in place to monitor the progress of the vessel. All too often, a pilot's decision making can become the weak link in a system prone to single-point failure; i.e., in the absence of effective monitoring, there is little safety backup for the pilot in the navigation of the vessel.

There is a significant difference in the stated experiences of masters/OOWs and pilots when it comes to the monitoring of the vessel movements under the conduct of a pilot. Almost all the masters and OOWs who responded stated that they "always" or "often" monitored the vessel movements and plotted her position. Only about half the pilots agreed that this was their experience. This difference in experiences might be due to a lack of communication. The masters and OOWs might indeed be regularly plotting and monitoring the vessel movements, but if this information is not being communicated to the pilot, he will indeed experience a feeling of being alone and solely responsible for the navigation of the vessel.

Monitoring vessel movements and plotting her position are essential tasks in maintaining situational awareness while navigating a vessel. Situational awareness is impaired by inadequate feedback or information. The occurrences involving the "CANADIAN EXPLORER", the "HALIFAX" and the "IRVING NORDIC" are examples of the vessel movements not being monitored and situational awareness being lost.

Monitoring vessel movements is critical to safe navigation in compulsory pilotage waters. It depends on effective communication among the bridge team. In order for the OOW to effectively monitor the vessel movements, he should know the pilot's passage plan. For the pilot to maintain his situational awareness, he must be provided with feedback from the OOW on the vessel's position relative to the plan.

The Board has previously recommended that:

The Department of Transport require that the pilotage authorities publish official passage plans for compulsory pilotage waters and make them available to masters to facilitate monitoring of the pilot's actions by the vessel's bridge team.

(TSB Recommendation M94-34, December 1994)

Although the Department has rejected this recommendation, the Board notes that inadequate monitoring of a vessel's position is frequently associated with groundings and strikings. The Board considers that close and continuous monitoring of a vessel's progress following an agreed passage plan is essential for the safe conduct of the vessel. Accordingly, the Board further recommends that:

The Department of Transport require that pilots, as part of their initial hand-over briefing:

- a) obtain the master's agreement to the intended passage plan; and
- b) invite the bridge team's support by having the officer of the watch plot and monitor the vessel's position at regular intervals and report the position to the pilot with respect to the agreed passage plan.

M95-08

4.4 Teamwork

Misunderstanding among the bridge team, lack of adequate information exchange, incomplete understanding of the intended manoeuvres, loss of situational awareness, absence of monitoring of the ship's progress, etc., as evidenced by the Canadian marine occurrence experience, are symptomatic of more fundamental problems in bridge practices. Such factors suggest deficiencies in the effectiveness of current bridge team management practices in compulsory pilotage areas.

A lack of teamwork on the bridge of vessels in Canadian pilotage waters is continuing to compromise safe navigation. The recent occurrences involving the "CONCERT EXPRESS", the "LAKE ANINA", the "MALINSKA", the "HALIFAX" and the "IRVING NORDIC" all point to a lack of communication and cooperation as contributing factors in the occurrences.

As it has stated in the past, the Board continues to believe that increased emphasis on information exchange and coordination could improve bridge team management and therefore advance safe navigation. Systematic instruction of ship officers and marine pilots in operating practices and procedures designed to facilitate information exchange and coordination among all members of the bridge team is required.

The overwhelming majority of pilots, masters and bridge officers who responded to the Board's questionnaire rated teamwork as important as technical proficiency for safe navigation. However, less than half of those who responded stated that they always worked as a team. The accident record confirms that current bridge procedures and practices frequently reflect an absence of teamwork.

In rejecting the Board's Recommendation M94-34 regarding passage planning, the Department of Transport stated (22 March 1995):

However, it is believed that a more effective bridge resource management regime (including enhanced communication between the pilot and the officer of the watch), rather than a voyage plan, may potentially have contributed to the incident being avoided.

The Board notes the intention of the Department of Transport to develop optional training courses in Bridge Resource Management. However, the Board is concerned that optional training

might not have the desired effect within the industry. Not all the major constituents of the marine industry have indicated strong support for such training.

Bridge Resource Management, the managing of human and technical resources in an operational marine environment, is a function comprising several elements. These include the application of effective communication, the use of briefings and debriefings, and the creation of an environment where all members of the bridge team feel free to question assumptions and actions.

As a result of the problems identified in this study relating to the absence of hand-over briefings, the ineffective monitoring of the vessel's position and in view of the frequency of occurrences involving demonstrated breaches of sound teamwork principles, the Board recommends that:

The Department of Transport require that the initial training syllabus for all ship officers be modified to include demonstration of skills in Bridge Resource Management.

M95-09

that:

The Department of Transport require that all ship officers demonstrate skills in Bridge Resource Management before being issued Continued Proficiency Certificates.

M95-10

and that:

The Department of Transport require that all pilots demonstrate skills in Bridge Resource Management before the issuance and/or renewal of a pilotage licence.

M95-11

The Board recognizes that unilateral action by one nation will not satisfactorily address the global issue of ineffectual teamwork with multinational crews on foreign vessels. Concerted action by leading maritime nations will be required to effect the cultural changes necessary to make BRM an accepted part of day-to-day bridge practices. Increased awareness of the benefits of formal BRM training to ensure safe and therefore profitable shipping operations will be required throughout the industry. Therefore, the Board recommends that:

The Department of Transport, through the International Maritime Organization, actively promote the provision of formal training in Bridge Resource Management to all ship officers and marine pilots and the benefits of such training.

M95-12

5.0 APPENDICES

APPENDIX A - TABULATION OF MASTER/PILOT EXPERIENCES

The responses to the first 20 questions of the questionnaire are tabulated below.

1. In my experience, communication, teamwork and cooperation among all personnel on the bridge are as important as technical proficiency for safe navigation and ship handling.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	85.9%	9.9%	2.1%	0.0%	2.1%
BRIDGE OFFICERS	94.2%	5.8%	0.0%	0.0%	0.0%
PILOTS	66.1%	19.2%	5.4%	3.1%	6.2%

2. In my experience, when the pilot comes on board, the master or officer of the watch informs the pilot of the manoeuvring characteristics of the vessel for its present condition.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	75.2%	18.3%	5.6%	0.0%	0.9%
BRIDGE OFFICERS	71.1%	23.1%	5.8%	0.0%	0.0%
PILOTS	19.3%	22.3%	56.9%	0.0%	1.5%

3. In my experience, the pilot informs the master of local conditions which might affect the pilotage passage.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	26.1%	34.5%	37.3%	1.4%	0.7%
BRIDGE OFFICERS	30.8%	44.2%	21.2%	3.8%	0.0%
PILOTS	63.9%	22.3%	11.5%	0.8%	1.5%

4. In my experience, the pilot informs the master of his manoeuvring plan for the vessel.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	23.9%	24.6%	44.5%	6.3%	0.7%
BRIDGE OFFICERS	34.6%	23.1%	30.8%	11.5%	0.0%
PILOTS	50.8%	28.5%	14.6%	2.3%	3.8%

5. In my experience, the master ensures that the pilot's passage plan and local conditions are suitable for the vessel.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	65.5%	17.6%	12.0%	1.4%	3.5%
BRIDGE OFFICERS	59.6%	21.2%	19.2%	0.0%	0.0%
PILOTS	16.2%	20.8%	43.8%	13.8%	5.4%

6. In my experience, the officer of the watch monitors the vessel's movement when the pilot has the conduct of the vessel.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	73.3%	21.8%	4.2%	0.0%	0.7%
BRIDGE OFFICERS	86.6%	9.6%	1.9%	1.9%	0.0%
PILOTS	13.8%	36.9%	46.3%	1.5%	1.5%

7. In my experience, the officer of the watch plots the vessel's position regularly when the pilot has the conduct of the vessel.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	66.9%	23.3%	7.7%	2.1%	0.0%
BRIDGE OFFICERS	71.2%	17.3%	9.6%	1.9%	0.0%
PILOTS	15.4%	33.1%	49.2%	0.8%	1.5%

8. In my experience, the pilot assists the officer of the watch in the monitoring of the vessel's movements.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	16.9%	26.8%	40.8%	12.7%	4.8%
BRIDGE OFFICERS	19.2%	23.1%	44.3%	11.5%	1.9%
PILOTS	26.9%	21.5%	42.3%	6.2%	3.1%

9. In my experience, the pilot makes sure his orders are understood and acknowledged by the officer of the watch.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	50.0%	25.4%	17.6%	7.0%	0.0%
BRIDGE OFFICERS	50.0%	26.9%	17.3%	5.8%	0.0%
PILOTS	83.8%	10.8%	2.3%	0.8%	2.3%

10. In my experience, if the officer of the watch becomes unsure of the pilot's intentions, he asks for clarification.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	46.5%	29.6%	22.5%	0.7%	0.7%
BRIDGE OFFICERS	69.2%	21.2%	9.6%	0.0%	0.0%
PILOTS	20.7%	18.5%	50.0%	5.4%	5.4%

11. In my experience, informative hand-over briefings, master to pilot, pilot to pilot, and pilot to master are carried out.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	46.5%	29.6%	22.5%	0.7%	0.7%
BRIDGE OFFICERS	69.2%	21.2%	9.6%	0.0%	0.0%
PILOTS	20.7%	18.5%	50.0%	5.4%	5.4%

12. In my experience, communications between the pilot and bridge personnel are effective.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	52.8%	28.9%	15.5%	1.4%	1.4%
BRIDGE OFFICERS	51.9%	32.7%	13.5%	0.0%	1.9%
PILOTS	43.1%	42.3%	12.3%	0.0%	2.3%

13. In my experience, the pilot, the master and the officer of the watch work as a team in the conduct of the vessel.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	50.7%	33.1%	14.8%	1.4%	0.0%
BRIDGE OFFICERS	46.1%	40.4%	13.5%	0.0%	0.0%
PILOTS	37.7%	25.4%	28.5%	6.9%	1.5%

14. In my experience, bridge officers are reluctant to question the pilot's decisions.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	6.3%	31.7%	54.3%	7.7%	0.0%
BRIDGE OFFICERS	11.5%	21.2%	44.3%	19.2%	3.8%
PILOTS	6.9%	33.1%	39.2%	16.2%	4.6%

15. In my experience, it is possible to establish an effective working relationship with the master and officer of the watch.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
PILOTS	47.6%	36.2%	10.8%	0.0%	5.4%

16. In my experience, on foreign-registered vessels, language barriers make it difficult to communicate orders to the helmsman.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
PILOTS	1.5%	20.0%	60.1%	14.6%	3.8%

17. In my experience, on foreign-registered vessels, language barriers prevent an effective exchange of information with the master and officer of the watch.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
PILOTS	1.5%	23.1%	54.7%	16.9%	3.8%

18. In my experience, pilots offer all necessary information regarding pilotage and manoeuvring plans for the vessel.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	24.7%	30.3%	38.7%	4.9%	1.4%
BRIDGE OFFICERS	28.8%	38.5%	30.8%	1.9%	0.0%

19. In my experience, pilots ensure that relevant communications with traffic control centres or other vessels are conveyed to me.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	24.6%	29.6%	33.1%	9.2%	3.5%
BRIDGE OFFICERS	26.9%	26.9%	40.5%	3.8%	1.9%

20. In my experience, I am apprised by the pilot of all safety communications regarding the navigation of the vessel in pilotage waters.

	ALWAYS	OFTEN	SOMETIMES	NEVER	NO RESPONSE
MASTERS	32.4%	29.6%	29.6%	4.9%	3.5%
BRIDGE OFFICERS	32.8%	28.8%	26.9%	7.7%	3.8%

APPENDIX B - TABULATION OF DEMOGRAPHIC INFORMATION

Pilots - 130 responses⁶

● Authority

	No.	%
Atlantic	27	20.8
Laurentian	54	41.5
Great Lakes	25	19.2
Pacific	16	12.3
No Response	8	6.2

● Experience (years)

	0 - 5	5 - 10	10 - 15	15 - 20	20 +	No Response
As Pilot	9.2 %	8.5%	11.5%	25.4%	40.0%	5.4%
As Master	19.2%	10.0%	3.8%	5.4%	32.4%	29.2%
As Bridge Officer	16.9%	27.7%	7.7%	2.3%	13.1%	32.3%

⁶ This sample of 130 responses from an estimated population of 422 marine pilots provides 95% confidence, $\pm 10\%$, that the views of these pilots reflect the views of the total population of marine pilots.

Masters - 142 responses⁷

- Nature of Trade

	No.	%
Foreign Going (FG)	66	46.5
Home Trade (HT)	16	11.3
Inland (IL)	32	22.5
FG & HT	4	2.8
FG & IL	1	0.7
HT & IL	13	9.2
No Response	10	7.0

- Experience (years)

	0 - 5	5 - 10	10 - 15	15 - 20	20+	No Response
As Master	24.7%	13.4%	21.8%	14.8%	23.9%	1.4%
As Bridge Officer	2.8%	21.1%	22.5%	13.4%	13.4%	26.8%

⁷ This sample of 142 responses from a large but unknown population of masters provides 95% confidence, $\pm 10\%$, that the views of these masters reflect the views of the total population of masters.

Bridge Officers - 52 responses⁸

● Nature of Trade

	No.	%
Foreign Going (FG)	19	36.5
Home Trade (HT)	8	15.4
Inland (IL)	14	26.9
FG & HT	0	0.0
FG & IL	0	0.0
HT & IL	9	17.3
No Response	2	3.9

● Experience (years)

	0 - 5	5 - 10	10 - 15	15 - 20	20+	No Response
As Master	15.4%	0.0%	7.7%	7.7%	3.8%	65.4%
As Bridge Officer	1.9%	21.2%	40.4%	26.9%	9.6%	0.0%

⁸ This sample of 52 responses from bridge officers provides 95% confidence, $\pm 15\%$, that the views of these bridge officers reflect the views of the total population of bridge officers.

Pilotage areas with which masters and bridge officers are most familiar:

Pilotage Region	Masters	Bridge Officers
Atlantic (ATL)	8.5 %	11.5 %
Laurentian (LN)	16.9 %	19.2 %
Great Lakes (GL)	10.5 %	5.8 %
Pacific (PAC)	10.6 %	5.8 %
Arctic (ARC)	0.7 %	0.0 %
ATL & LN	6.3 %	5.8 %
ATL & LN & GL	9.9 %	13.5 %
LN & GL	19.7 %	28.8 %
No response	16.9 %	9.6 %

Number of times masters and bridge officers have sailed in Canadian waters with the assistance of a pilot in the last five years:

	0 - 5	5 - 10	10 - 15	15+	No Response
Masters	11.3 %	10.6 %	7.7 %	69.0 %	1.4 %
Bridge Officers	3.8 %	7.7 %	5.8 %	82.7 %	0.0 %